# Intensive X-Ray Survey for Tuberculosis in a Rural County

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*SUMMARY*

*In an intensive fast-tempo tuberculosis case-finding survey in a rural county 34,345 residents (73 per cent of all persons 15 years of age or over) had miniature x-ray films of the chest taken. In 256 instances, x-ray findings were consistent with pulmonary tuberculosis. Sixty-eight persons were ultimately reported as having active tuberculosis (one case of active tuberculosis for every 505 persons covered by the survey). Within one year, 57 of them had been hospitalized for treatment. Only four of the 68 cases had been known to the health department before the survey.*

*The cost of the survey (80 cents per person surveyed and $444.58 per case of active tuberculosis) compares favorably with that of other surveys.*

THE control of tuberculosis in a community necessitates, as a first step, knowledge of the extent of the problem and identification of the persons who have the disease. Because of the relative or complete absence of symptoms in early active tuberculosis, mass x-ray survey is an effective and necessary tool in the tuberculosis control program.

Although, in the past, tuberculosis has taken its greatest toll in urban populations, evidence is accumulating that the death rate from tuberculosis in cities has declined much more rapidly than in rural areas.[3] It has even been predicted that urban death rates may eventually drop below rural rates. This trend underlines the need for rapid betterment of health services in rural areas, including more active case finding, follow-up and hospitalization, as well as improvement in rural housing, education, nutrition, and general living standards.

Imperial County, one of the important rural, agricultural areas along the southern border of California, has a population of 62,975.* High tuberculosis mortality rates and a high ratio of far advanced cases reported annually have, for years, indicated that a considerable reservoir of infection existed within the county. Chest clinics were conducted monthly by visiting specialists, but case-finding programs had been limited to several small scale surveys covering only about five or six per cent of the eligible population. The facilities for the care of tuberculous persons were limited to a 22-bed ward at the county hospital. At every chest clinic, the diagnosis of new cases of tuberculosis was met by the discouraging fact of insufficient beds in which to place the patients. About half of all known deaths from tuberculosis, over a five-year period, occurred in the home and 60 per cent of the persons who died of tuberculosis were not reported as having the disease prior to death. It was significant that 65 per cent of the deaths were among Spanish-speaking people, although only 35 per cent of all the people in the county are Spanish-speaking.

For over a decade, the serious nature of this community problem had impressed itself upon the Imperial County Board of Supervisors, the Imperial County Tuberculosis Association, the county health officer, and the civic leaders in the county. World War II, however, prevented crystallization of plans for the improvement of these conditions. In November 1948 the board of supervisors secured the former naval auxiliary air station. It was converted into a tuberculosis hospital of 195 beds and staffed by two full-time tuberculosis specialists, a visiting tuberculosis consultant and a visiting chest surgeon.

With an adequate number of beds for persons with tuberculosis thus provided, attention was centered on a more complete tuberculosis control program in the health department. Upon the arrival of a new full-time health officer in 1949, tuberculosis was given first priority among many knotty public health problems. A request by the health officer for assistance in conducting an intensive county-wide x-ray survey was approved and sponsored by the Imperial County Medical Society, the Imperial County Tuberculosis Association, and civic organizations. The California Department of Public Health and the California Tuberculosis and Health Association agreed to furnish the necessary equipment and personnel.

The local health and welfare council acted as a steering committee and aided in the formation of the Imperial County Chest X-ray Survey, which then functioned under an executive coordinator. Medical, nursing, and social service policies were determined by local committees.† Funds were secured by appropriation by the board of supervisors, the Imperial County Tuberculosis Association, and by public subscription. The locations committee arranged a schedule for placement of x-ray units in every com-

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* U. S. Department of Commerce, 1950 census.

† Organization of the survey was directed by Edward Kupka, M.D., chief of the Bureau of Tuberculosis Control, California Department of Public Health.

munity in the county. An extensive volunteer canvassing committee, armed with this schedule and with information answering possible objections and questions, contacted every home in the county, "selling" the survey by direct personal presentation. A high-pressure publicity campaign was carried out preceding and during the survey, using radio, press, sound equipment, and every other available medium of publicity. The negative aproach, emphasizing fear of tuberculosis, was avoided. Other committees organized activities in the schools, business, industry, and agricultural groups. The entire organization was, in every sense, the expression of the desires of the community, and the success of the survey was largely the result of the work done by those in every level of community life who were willing to put time and effort into the task to be accomplished.

Because of the importance of giving the subjects prompt notification of the results of the miniature films, the reading of the films was expedited from the start of the survey; within a week of the taking of the x-ray, either a negative report card or a letter of appointment for a confirmatory large film was in the mails. Persons for whom treatment was urgent were notified directly by a public health nurse.

The procedure for follow-up, as determined by the medical committee, was to take a confirmatory, large film at the retake center in all cases in which the reading of the miniature film suggested pulmonary tuberculosis or significant non-tuberculous conditions. In order to avoid neglect on the part of the patient to follow through in what might prove to be symptomless, active tuberculosis, the medical committee also desired that every effort be made to reach a satisfactory conclusion within a minimum period of time. In line with this policy, a tuberculosis clinician was on duty continuously at the retake center. As soon as the 14 x 17-inch x-ray film was taken, the clinician reviewed both the miniature film and the large wet film. With the information furnished by the epidemiological history taken by one of the clinic nurses and by consultation with the patient, it was possible in many cases to reach at once a tentative conclusion. Thus, it was possible, immediately, to relieve the minds of some persons with the information that in the large films there was no evidence of tuberculosis. If changes consistent with presumably active tuberculosis were observed on the film, the patient was informed of the findings, was instructed as to collection of sputum for examination, and was advised of the probable need of treatment. At the direction of the health officer, some of these patients were referred directly to the social welfare department for investigation of the financial status in anticipation of admission to the sanatorium, and a considerably larger group were advised to secure further examinations either by their own physicians or at the chest clinic. In instances in which there was a history of tuberculosis many years ago and the present findings indicated an obsolete tuberculous lesion with complete absence of symptoms, the subject was informed of the findings and dismissed with the advice that in the event of recurrence of any symptoms, medical aid should be sought.

If the miniature film was suggestive of some non-tuberculous pulmonary disease and there were sufficient indications in the large film, or if symptoms were present, the subject was referred to his own physician for further investigation. The miniature or large film was made available to the physician in each case, together with other information contained in the records. Persons in whom heart disease was suspected also were referred to their physicians, without 14 x 17-inch films.

## RESULTS

Over a period of nearly seven weeks, with a total of 109 unit-days, the team operating the three mobile x-ray units took a total of 37,934 miniature x-ray films, an average of 348 per unit per day. Of the total number of persons surveyed, 3,589 lived outside of Imperial County; over two-thirds of these had come over the border from Mexico for the x-ray survey. The remaining 34,345 were either legal residents of Imperial County or Mexican nationals regularly employed in the county. It is estimated that 75 per cent of the total population—47,231 persons—was made up of people 15 years of age or over. The 34,345 residents surveyed, therefore, represented 73 per cent of the eligible resident population.

In the total of 37,934 miniature films, there were 859 in which there was indication of disease in the chest—of pulmonary tuberculosis in 572 instances (1.5 per cent). Of the 572 persons with suspicion of tuberculosis, 527 reported at the retake center for a large film and examination. The other 45 either could not be located or were referred to other health jurisdictions because they were non-residents.

On the basis of the examination at the retake center, a tentative diagnosis of pulmonary tuberculosis was made in 256 cases and, of these, 68 were ultimately reported as cases of active pulmonary tuberculosis by private physicians, by physicians at the chest clinic, or by physicians at the sanatorium, and 57 of the patients were hospitalized for treatment—51 in the Imperial Valley Sanatorium and the remainder in private or government sanatoria. Only four of the 68 reported cases had been known to the health department before.

Of the 51 patients hospitalized in Imperial Valley Tuberculosis Sanatorium, 43 (84 per cent) had tubercle bacilli in the sputum. Thirty-one (61 per cent) were of Spanish-American descent (of whom

TABLE 1.—*Miniature Film Findings—Imperial County Survey, December 1949 to January 1950*

| | Number | Pct. |
|---|---|---|
| Total number of persons in survey | 37,934 | |
| Essentially normal films | 37,075 | 97.7 |
| Possible abnormal chest conditions: | | |
| A. Suspected pulmonary tuberculosis | 572 | |
| B. Suspected cardiovascular disease | 151 | |
| C. Suspected other disease | 136 | |
| | 859 | 2.3 |

TABLE 2.—*Confirmatory (14x17-inch) Films—Imperial County Survey*

| | | |
|---|---|---|
| Number of Imperial County residents in survey | | 34,345 |
| Number of confirmatory (14x17-inch) films | | 527 |
| Number with x-ray impression of pulmonary tuberculosis: | | |
| Minimal pulmonary tuberculosis | 169 | |
| Moderately advanced pulmonary tuberculosis | 59 | |
| Far-advanced pulmonary tuberculosis | 28 | |
| | | 256 |

TABLE 3.—*Disposition of Tuberculous Patients—Imperial County Survey*

| | | |
|---|---|---|
| Hospitalized | | 57 |
| Imperial Valley Tuberculosis Sanatorium | 51 | |
| Other California sanatoria | 6 | |
| Returned to Mexico | | 35 |
| Referred to private physicians or chest clinic for further study and treatment | | 112 |
| Dismissed as disease was presumably inactive | | 52 |
| Total | | 256 |

TABLE 4.—*Admission and Discharge Data—Imperial County Tuberculosis Sanatorium*

| Extent of Lesion | Admission (to Dec. 31, 1950) Male | Female | Total | Discharge (to Dec. 31, 1950) Male | Female | Total |
|---|---|---|---|---|---|---|
| Minimal | 3 | 2 | 5 | 1 | 1 | 2 |
| Moderately advanced | 21 | 11 | 32 | 4 | 0 | 4 |
| Far advanced | 11 | 1 | 12 | 1 | 0 | 1 |
| Meningitis | 0 | 1 | 1 | 0 | 1 | 1 |
| Observation | 0 | 1 | 1 | 0 | 1 | 1 |
| | 35 | 16 | 51 | 6 | 3 | 9 |

21 were born in Mexico), 17 were native-born white, two were Filipino, and one a Negro. Only three had been residents of California less than five years. Nineteen were engaged in some type of agricultural work; 11 were housewives. Males outnumbered females by more than two to one. Thirty-two were over 40 years of age.

During 1950, eight patients were discharged from the Imperial County Tuberculosis Sanatorium, and one died. The patient who died, a woman, had tuberculous meningitis at the time of admission. One patient was discharged as non-tuberculous. The rest were either transferred to other institutions or left against medical advice. Because of the comparatively short period of time since their admission, no patients have been discharged as having inactive or arrested tuberculosis.

A phase of the tuberculosis control program which constitutes an especially difficult problem in Imperial County is the ease with which citizens of Mexico can cross the border.[1] Since 1945, no fewer than 45,000 "crossing cards," which permit the holders to enter the county from Mexico for employment by the day or for business purposes, have been issued. The state of health of the holders of these cards is not investigated. The importance of this practice to the health of Imperial County residents can be judged by the results of a spot check of 2,556 miniature x-ray films taken in Calexico, near the border. Forty-seven per cent of the subjects gave Mexicali as their home address. In 4 per cent of the miniature films of Mexicali residents, abnormalities consistent with pulmonary tuberculosis were noted, compared with 2.4 per cent with regard to residents of Calexico. It has been suggested that some of the Mexicali residents crossed the border for confirmation of an earlier diagnosis made in Mexicali, but the important facts remain that they were able to cross the border freely, and that those with active tuberculosis thus constitute a health hazard to persons with whom they may come into contact in Imperial County.

## COST

The cost of the survey was $30,230.46, of which 67 per cent was borne by the California Department of Public Health and the California Tuberculosis and Health Association, and 33 per cent locally. One-third of the local cost was carried by the Imperial County Tuberculosis and Health Association, and a little over one-third by the Imperial County Health Department, and the rest by public contributions and donations by the cities of El Centro and Calexico, labor unions, and others. Nearly half of the local health department expenditure was for regular personnel, assigned to the survey. The services of the large number of volunteer workers, without which the survey would have been impossible, are not included.

The total cost per person covered by the survey was 80 cents (of which the local share was 26 cents). The cost per person with a presumptive (x-ray) impression of pulmonary tuberculosis was $118.09, and the cost of finding each of the 68 reported cases of active tuberculosis was $444.58. The cost per patient hospitalized was $530.36. These figures compare favorably with results elsewhere. For instance, in the Seattle survey, the cost per active case discovered was $685.[2]

## DISCUSSION

The policy laid down by the local medical committee whereby every person who had a confirmatory film was interviewed by a physician at the time the retake x-ray was made, proved to be very efficient. Not only was the need for an additional visit done away with in most cases, but there was a psychological advantage in discussing with the individual, at the time his interest was greatest, the question—what needs to be done? A complete, final clinical evaluation still was necessary, of course, but a valuable start was made and, in some cases of obviously active advanced disease, hospitalization was effected in a very short time. In the majority of instances, the patient was referred to a private physician or the chest clinic for study and evaluation, with treatment or referral to the sanatorium.

Beyond the results of the survey in the number of cases of previously unrecognized tuberculosis discovered and the number hospitalized, other assets

were apparent. The survey indicated the need for improvement in the control of those with active tuberculosis crossing the border, whether they are so-called "nationals," who enter the United States under well-defined contract, or residents from across the border who carry a "crossing card," or illegal entrants.

The effect of the survey was agreeably apparent in increased interest in tuberculosis during the following year. One evidence of this interest was an awareness of the cost of the entire tuberculosis program, resulting in an investigation into the costs of treatment. The end result was that those who at first complained of the cost became firm supporters of the sanatorium and of the board of supervisors in their wise provision for adequate care of persons found to have active tuberculosis. There was also a well-defined increase in interest on the part of the public at large in the health program of the county, not only in tuberculosis but in other fields as well. Finally, in the year following the survey, there was an increase in the investigation and diagnosis of diseases of the chest, particularly tuberculosis, as compared with the pre-survey period. In most cases in which tuberculosis was diagnosed in the year following the survey, the patient had not been included in the survey. In several instances, however, the patient had had a survey film and a "negative" report upon it. In those instances, comparison of the more recent film with the survey miniature film indicated that the disease was new, that the miniature film taken in the survey was really "negative." All of these benefits, often considered as secondary to case-finding, are of sufficient value in themselves to justify the expense and effort put forth in carrying out such a survey.

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